

A LOOK AT NEW MEXICO'S WATER PROBLEMS

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I am especially happy to attend this Third Annual New Mexico Water Conference, not only because of the opportunity to represent the United States Geological Survey but also because the subject of this conference is one which interests me greatly as an individual.

This interest goes back a long way - longer than I like to be reminded of - but suffice it to say the from 1925 to 1928 my Geological Survey colleagues and I worked with the people of Chaves and Eddy Counties in a study of the problems of the Roswell artesian basin. I am informed that in the Pecos Valley, at least, the results of those studies are fairly well known, and that they seemingly have had some effect on the State's water policies. To provide the background for subsequent remarks, a brief review of some of the history of that work may be of interest.

Extensive use of the Roswell artesian basin as a source of water for irrigation farming began around the turn of the century. Soon it was recognized that this use was affecting the artesian head and that some degree of regulation was desirable. The first act of the State Legislature regarding use of water from the basin was passed in 1905, and, as conditions continued to deteriorate, a series of legislative acts were passed during the 20-year period ending in 1925. By this time it had become evident that some evaluation of the magnitude of the water resource would have to be made. The Geological Survey was called in and the investigation I mentioned earlier was undertaken. The results were published in U. S. Geological Survey Water-Supply Paper 639 and in the Biennial Reports of the State Engineer of New Mexico.

It didn't take very long to get a reasonably accurate idea of the amount of water available from the artesian basin. But what did take some time was to acquaint the people of these counties with our appraisal and to reach some reasonable conclusion as to what should be done to improve conditions in the artesian basin. As a result of a recommendation made in the preliminary report of the Survey's investigations, published in 1926, a law was passed in 1927 which declared certain waters to be public waters subject to appropriation for beneficial use. Although declared unconstitutional on technical grounds

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by the State Supreme Court in 1929, that bill, suitably modified, was the basis for the 1931 Act of the State Legislature, which has become a model for much other ground-water legislation throughout the West.

Not yet can it be stated, however, that this act has solved the ground-water problems of the Roswell artesian basin, or of the State as a whole. The impact of a great expansion in farming activities, due to high agricultural prices, and of a rapidly expanding population was too much for it. Thus, the Geological Survey's studies have not yet led the people of this State out of the apparent wilderness in which they find themselves. It merely pointed the way. There is no panacea which will solve all existing problems.. So that there may be no misunderstanding as to my position, it may be pertinent to call attention to the subject of my discussion, namely, "A Look at New Mexico's Water Problems." In the final analysis of our subject, I become simply one more worker in what has turned out to be a pretty complicated vineyard.

During the 30 years that have elapsed since the Survey's study of 1925-28, I have not been intimately in touch with all the excellent water studies that have been in progress in New Mexico, but I have followed with more than casual interest the forthright efforts of State administrators in applying scientific knowledge in the administration of water rights in the State. Despite this absence of intimate contact, I hope I may be pardoned for making some comments as to the nature of New Mexico's water problems, and I may even go so far as to indicate what might be done about some of them.

One conclusion that can be reached is that no one can consumptively use the water of a stream system, including its tributary ground water, without affecting the supply available to his neighbor.

A second conclusion is that the primary and determining characteristic of a water resource, and the one that differentiates it from other resources, is its variability.

Lest these conclusions be dismissed as being too obviously fundamental, let me say that every water problem stems from trying to ignore or to overcome one or both of them.

The Territory and State of New Mexico have dealt with water problems for more than 100 years. If these two conclusions are valid and if they have been recognized in one form or another for 100 years, why is it necessary to have meetings like this one? Why is it that today we seem to be in such an uncomfortable - shall we say - situation with respect to water use? It is not enough to say that we don't have enough water; it has been known for 100 years that New Mexico's climate is largely arid to semiarid, there being only small areas that are subhumid.

It took 100 years for our present development and demand for water to evolve. This leads me to a third conclusion - it is that our ability to cope with water-resource problems cannot exceed our understanding of them.

When water-resource development began in New Mexico the first two conclusions were quickly recognized and the conditions were equally quickly remedied. The doctrine of prior appropriation took care of the first deficiency and storage of water the second, insofar as surface-water supplies were concerned. Ground water, however, as a source of water supply, was of no particular importance - something that could be left, along with some other intangible and indeterminate problems, to the water witches and to students of supernatural phenomena. The fact that we had no knowledge about a very considerable portion of what today we call the hydrologic cycle didn't make much difference. All of which indicates what a tremendous margin for error there was in the utilization of the State's water supplies. It was not surprising, therefore, that problems of the future did not figure prominently or cause much concern during our first 50 years of development.

That is not to say, however, that there were no problems. Certainly there were. For a long time, if what we hear is true, the shotgun must have been just as important to the irrigator as his shovel. But along with measurement of water came statutory law and court decrees - with order, came organization. And, with organization, came a more complex development which used a greater proportion of the water resource. Thus by 1906 we had the ability to conceive and plan the Rio Grande project, including the tremendous Elephant Butte Dam, then forming the largest artificial reservoir in the world.

But, unnoticed and unconsidered, like the flaw in the title to the homestead in the old melodramas, were two important facts. Even after 50 years we didn't understand the hydrologic cycle fully, and we didn't realize how widely a water supply might vary.

As might be expected, an artesian basin was the first important source of ground water developed for irrigation use in New Mexico. I say "expected" because, where pumping is not needed, water is available at low cost. But the rapid changes brought about by increased water withdrawal in the Roswell area had an important effect which we don't think of today. One of the important reasons that prompted the Roswell investigation was that the farm loan banks considered the long-term availability of water so uncertain that loans for farming operations were made only on the basis of dry-land values of \$10 to \$15 per acre, whereas irrigated lands having a good water right were valued at \$250 to \$300 an acre. Other capital was available only at high rates of interest, 10 to 12 percent. So, although water might be cheaply available, the cost of developing a farm was high.

The Geological Survey's study in 1925-28 had two purposes, to delineate the magnitude of the water resource, and to establish the basis for a means of regulating the use of water in the basin. It is interesting to note that the means of regulating the use of water proved to be the extension of the doctrine of appropriation. The 1927 act declared that waters "in underground streams, channels, artesian basins, reservoirs or lakes, the boundaries of which may be reasonably ascertained by scientific investigations or surface indications" were public waters and subject to appropriation for beneficial uses under existing State laws relating to surface-water supplies. Subsequent history has shown that the magnitude of the water supply was evaluated successfully and that most of the financial difficulties were overcome.

Many technicians recognized in 1927 that there were certain deficiencies in the proposed code for the control of the use of ground water. The most important was in trying to separate ground water from surface water and, at the same time, applying to ground water the same regulations that were currently being applied to the use of surface waters. Furthermore, the law was made applicable to specific classes of ground water. Fortunately, New Mexico did not wind up with as many different kinds of ground water as some States.

Several reasons can be given as to why things were done the way they were. First, we did not possess our present-day tools for measuring and evaluating the role of ground water in the hydrologic cycle. Second, the authors of the 1927 act knew that the classes of ground water to which the law applied were cumbersome and unrealistic, and were not those endorsed by competent hydrologists. However, court decisions and water law in the West had so firmly established the pattern of classifying ground water that they believed that, in order to obtain the passage of legislation which would provide some measure of control over the withdrawal of artesian water, it was necessary to adhere to accepted legal terminology. Had the authors of the 1927 act simply stated that all ground water was public water subject to appropriation for beneficial use, it is doubtful that a law would have been enacted until many years later. From a practical standpoint, the only important critical area at the time was the Roswell artesian basin. No proposal, satisfactory to the area in question, was to be jeopardized through an inability to achieve an understanding on a statewide basis. In other words, it was hard enough for Chaves and Eddy Counties to understand what their problems were. To attempt to educate the whole State at that time would have been impossible even if the education had been restricted to ground water. Still more impossible would it have been to point out the interconnection of ground water and surface water and to gain acceptance of the concept, now coming to be recognized as inevitable, that rights to interconnected surface and ground water must be correlated.

By the early 1940's, we had made a great deal of progress in resource development. We were coming more and more to understand the basic problems involved. The Rio Grande and Pecos River Joint Investigations had done much to evaluate major surface-water supplies in the State and to appraise their uses. Ground-water development in the Pecos and Mimbres Valleys was proceeding on what appeared to be a stable basis. Interstate agreement had been reached on the use of water in the Rio Grande. Discussions leading to the adoption of a Pecos River Compact were under way. Our water supplies, bolstered by the heavy precipitation of 1941 and 1942, looked good. By the end of the war it seemed as though we were well on our way to a new level of development of the water resources of the State.

But we still had not looked critically at some of the fundamentals of water-resource development. We still had not faced the first two of the conclusions that I have set forth today. So, in the last 10 years the errors of our past have caught up with us.

Since the war New Mexico has had a tremendous increase in population. This increase has been responsible for an ever-increasing demand for water. High prices for crops, increased efficiency of pumps and motors, and efficient farming methods have led to more intensive use of our water resource. But as communities have increased in size they have turned almost without exception to ground-water sources for new supplies of water.

At the same time, New Mexico has gone through a period of sustained drought. Declining amounts of surface runoff led to installation of pumps in areas which before had been wholly dependent on supplies delivered by gravity. Thus, at a cost, we met our water demand in the face of declining supplies. How long this could have been kept up I don't know, but certainly it is fortunate that we have had above-average precipitation for the last two years.

There is a real question as to how the drought we have been through compares with the droughts of former years. Though we may all hope for more abundant rainfall in the next few years, we should not overlook the fact that droughts will return. Even though the floods that have occurred in Texas in recent months are still in mind, Dr. Vance E. Myers, a University of Texas meteorologist, warned in an article in the Austin (Texas) Statesman of August 20, 1958, that droughts would return to Texas within the next 15 to 20 years. This forecast supplies emphasis to the fact that periods of plentiful precipitation will ultimately be followed by drier periods. The low runoff of the 1930's coincided with low farm prices and poor business conditions. What would the severe droughts of the past have been like if we had been trying to maintain or increase water yield in a time of declining supply? Are we, therefore, able to sustain our present demands upon our water supply without high-cost importation from areas which now are favored by a surplus of water?

The answer, as I see it, is clear. Under present conditions, no. The next question is, of course, is there anything that can be done about this situation? Here the answer is, perhaps. I am certain that we will find no panaceas, no quick and easy answers to our problem. What we must do is to really being to study water in all its forms and learn how to use it to the best advantage.

This study of the various phases of the hydrologic cycle must be undertaken so that all the forthcoming results remain in their proper perspective. We must understand why water does or does not precipitate as snow, rain, or hail, yet we must not be led, at the outset, to assume that cloud seeding or any other process is the cure to all our problems. We have to learn those conditions under which we can suppress evaporation at reasonable cost. We must study means of reducing the consumption of water by nonbeneficial vegetation. But we must also be certain that we know the difference between beneficial and nonbeneficial uses. With respect to this latter item, I can recall a period when tree planting was considered a means of modifying climate and creating more abundant water supplies. We all appreciate the beauty and value of trees and their usefulness in preventing erosion; however, it is now well understood that trees consume water as do other types of growing vegetation.

Our increasing demand on ground-water supplies has brought us into contact with water of poor quality. There is need for further study of the processes for the conversion of brackish waters to fresh water. Until we have evaluated the magnitude of our brackish-water resource and developed an efficient low-cost means of conversion, we must look elsewhere for help. In this connection it should be mentioned that the term "low-cost" in relation to processes for improving the quality of water is a relative one. A process may be considered low-cost if the yield in terms of salable product is sufficiently great to permit at least a reasonable profit. A process may be low-cost if it is used for producing an industrial product of high value. The same process may be high-cost if used to provide water of a quality suitable only for the irrigation of ordinary field crops.

Through this discussion I hope it is evident that we cannot expect any wonderful or miraculous cure for our water-supply problem. Until we realize this we are not going to get at the heart of the situation. Our chief problem is that of determining how we shall use a resource that varies in magnitude. It is entirely evident that we must know something about this resource, but, having done that, we are confronted with the crux of the problem - how do we, as water users, agree to use this resource? As Shakespeare said, "Ah, ther's the rub." Because, when we deal with people we are concerned with government operation and free enterprise, property rights and socialism, priority and state control, all of which may seem to have nothing to do with water. However, these subjects form the philosophic background of any discussion

that has to do with procedures devised to administer the use of this variable resource, and they must be considered in reaching solutions.

Up to the present time our efforts have been in the direction of trying to validate a use of water which is junior in right under the doctrine of appropriation. This has been done at a constantly increasing cost. It can be shown, however, that there is a physical as well as an economic limit to this process. Under the most careful plan of development we will have periods when there will be an expansion of use of water that cannot be sustained in other years. How do we, or do we, provide the organization and means of control that will hold down the waste of water by beneficial users and the consumption, by either evaporation or transpiration, that is of no benefit to mankind?

Our chief hope, it seems to me, is for an understanding of the situation at all levels among our people which will lead to a willingness to pay the cost of learning the limitations of the water resource and of adopting the measures that will enable its full development. The cost will be both economic and social. It will involve higher taxes to support the necessary investigations, and it will require social adjustments to realize the maximum economic return from every drop of water. And, at the same time, it will require just compensation for existing water rights which are transferred to other uses. This effort, of course, presupposes a full understanding of the water situation by those technical people who deal with water in its physical form. It is here that I must make reference to my own agency, the Geological Survey, to the Weather Bureau, and to the other agencies, governmental and private, that are engaged in the study of water, and to the administrators of the laws and regulations that govern the use of this resource. These are the people who must be responsible for the details of planning the water-management program of the future.

The situation, in brief, can be well summarized by a statement which appeared in a recent report issued by the Conservation Foundation of New York. It is quite applicable to the water problems of New Mexico, as well as to the water problems of many other areas in the United States:

"We are still developing water in shortage areas for uneconomic uses. We are blithely expanding our uses, and developing claims on water with no clear plan for its allocation. Water developments, once accomplished, are permanent commitments of capital, location, and economic prospects, as well as policy. But public policy, such as it is, has suffered a series of conflicting, antiquated or ill-thought-out and unrelated year-to-year actions...There will not be more water (barring some unlikely developments) in our time. There is water to be had, for a price in money, effort, and by careful thought, planning and compromise. Better use,

wise use, and full use are attainable goals. Entire water courses need development. We must guide the direction of our progress rather than drift into the future."

New Mexico, as a leader in water legislation in the West, already has a solid foundation of law on which to build the water developments of the future. She must now undertake the difficult effort of making those sound principles effective in terms of new legislation, development, and management that will safeguard her future for the next thousand years and beyond.

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